Difference Equations

2.1.1 Compound Interest

2.1.2 Loan Repayment

2.1.3 Gambler's Ruin

2.2.2 Exponential Population Growth

2.2.3 Average Lifespan

2.2.$\star$ Rabbit Populations

2.2.4 Nonlinear Population Models

2.1.1 Compound Interest

We put a certain amount of money in a savings bank account with an annual interest rate of $p\%$, and compounded at regular periods of α (in years).

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We put a certain amount of money in a savings bank account with an annual interest rate of $p\%$, and compounded at regular periods of α (in years).

1. If the interest is compounded monthly, what is α?
   What is α if the interest is compounded every 3 months?

Let S_k = amount of money in the bank account after k periods

2. Find an equation relating S_{k+1} and S_k.

3. Calculate S_1, S_2, S_3 in terms of S_0.

4. Can you find a pattern for S_k?

2.1.1 Compound Interest

The annual rate is $p\%$, but the interest is compounded.

5. If the interest was compounded annually, how much money should there be after one year?
6. After 1 year with a monthly compounded interest, is there more or less money than the one found for 5?
7. If each period is α long (in years), how many periods are there in a year?
8. How much money is there after one year?

The **effective interest rate $p_{\text{eff}}\%$** is the annual rate that gives the same amount of money at the end of the year as if it was compounded in periods of α at the rate $p\%$.

9. What is $p_{\text{eff}}\%$?